HALO PHENOMENA OBSERVED DURING AUGUST, 1918.

By WILLIS RAY GREGG, Meteorologist.

Halo phenomena observed during August, 1918.

Station.	Altitude.	Latitude.	Longitude.	Date.	Form observed.	Time of— Beginning.	Time of— Ending.	Theodolite readings. Time.	Radius inside.	Radius outside.	Length of arc.	Distance from sun or moon.	Altitude of sun or moon.
	m.	° ′	° ′						°	°	°	°	°
Broken Arrow, Okla.*	233	36 02	95 49	3	Solar halo, 22°	10:25 a. m.	3:30 p. m.	11:50 a. m.	21.5	22.2	360	.....	70.2
Canton, N. Y.	137	44 36	75 10	6	Solar halo, 22°	12:00 m.	12:40 p. m.	.....	.....	.....	.....	.....	.....
				7	Solar halo, 22°	7:30 a. m.	1:00 p. m.	.....	.....	.....	.....	.....	.....
				16	Lunar halo, 22°	9:30 p. m.	10:30 p. m.	.....	.....	.....	.....	.....	.....
				22	Solar halo, 22°	1:45 p. m.	3:00 p. m.	.....	.....	.....	.....	.....	.....
				22	Lunar halo, 22°	10:00 p. m.	.....	.....	.....	.....	.....	.....	.....
				30	Solar halo, 22°	1:35 p. m.	2:30 p. m.	.....	.....	.....	.....	.....	.....
Cincinnati, Ohio	191	39 06	84 30	None.		.....	.....	.....	.....	.....	.....	.....	.....
Dayton, Ohio	274	39 46	84 10	None.		.....	.....	.....	.....	.....	.....	.....	.....
Drexel, Nebr.*	396	41 20	96 16	None.		.....	.....	.....	.....	.....	.....	.....	.....
Ellendale, N. Dak.*	444	45 59	98 34	2	Solar halo, 22°	1:10 p. m.	1:25 p. m.	.....	.....	.....	.....	.....	.....
				3	Solar halo, 22°	8:00 a. m.	8:35 a. m.	8:10 a. m.	.....	.....	100	.....	28
				23	Solar halo, 22°	7:15 a. m.	8:00 a. m.	.....	.....	.....	.....	.....	.....
Groesbeck, Tex.*	141	31 30	96 28	6	Solar halo, 22°	10:40 a. m.	6:48 p. m.	10:47 a. m.	22	24	360	.....	63
				6	Upper tangent arc	4:13 p. m.	4:27 p. m.	4:15 p. m.	.....	.....	20	22	37
				6	Lower tangent arc	4:00 p. m.	4:20 p. m.	4:02 p. m.	.....	.....	10	23	40
				7	Solar halo, 22°	11:15 a. m.	12:37 p. m.	11:26 a. m.	22	23	360	.....	69
Leesburg, Ga.*	85	31 47	84 14	None.		.....	.....	.....	.....	.....	.....	.....	.....
Madison, Wis.	297	43 05	89 23	5	Solar halo, 22°	9:40 a. m.	10:00 a. m.	.....	.....	.....	.....	.....	.....
				7	Solar halo, 22°	7:50 a. m.	9:00 a. m.	.....	.....	.....	.....	.....	.....
				9	Solar halo, 22°	12:30 p. m.	.....	.....	.....	.....	.....	.....	.....
				21	Solar halo, 22°	7:00 a. m.	9:00 a. m.	.....	.....	.....	.....	.....	.....
Nashville, Tenn.	166	36 10	86 47	None.		.....	.....	.....	.....	.....	.....	.....	.....
Royal Center, Ind.*	227	40 53	86 29	27	Solar halo, 22°	8:42 a. m.	12:30 p. m.	.....	.....	.....	.....	.....	.....
				30	Solar halo, 22°	11:45 a. m.	12:15 p. m.	.....	.....	.....	.....	.....	.....

Station.	Date.	Colors.**	Degree of brightness.	Clouds. Amount.	Clouds. Kind.	Clouds. Direction.	Station pressure.	Precipitation. Last previous ended.	Precipitation. First subsequent began.
Broken Arrow, Okla.*	3	Y	Dim	6	Ci. St.	s.	Falling	9:00 p. m., 25th	D. N. p., 7th.
Canton, N. Y.	6	.....	.....	1	Ci. St.	w.	Rising	8:00 a. m., 6th	8:00 p. m., 6th.
	7	O. Y. G	Dim	2	Ci. St.	w.	Stationary	8:00 p. m., 6th	8:32 p. m., 7th.
	16	R. O. Y. G. B.	Dim	1	Ci. St.	w.	Stationary	9:50 a. m., 14th	9:27 p. m., 21st.
	22	O. Y. G	Dim	1	Ci. St.	w.	Falling	9:27 p. m., 21st	D. N. a., 24th.
	22	R. O. Y. G	Dim	4	Ci. St.	w.	Falling	9:27 p. m., 21st	D. N. a., 24th.
	30	R. O. Y. G	Dim	2	Ci. St.	w.	Falling	8:00 p. m., 29th	8:00 a. m., 31st.
Cincinnati, Ohio	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dayton, Ohio	.....	.....	.....	.....	.....	.....	.....	.....	.....
Drexel, Nebr.*	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ellendale, N. Dak.*	2	R	Dim	8	Ci. St.	nnw.	Falling	10:50 p. m., 31st	3:05 p. m., 2d.
	3	R	Dim	3	Ci. St.	nw.	Falling	4:10 p. m., 2d	6:10 p. m., 3d.
				4	A. St.	nw.			
	23	.....	Bright	2	Ci. St.	w.	Rising	12:00 m., 21st	6:30 p. m., 23d.
				3	A. St.	w.			
Groesbeck, Tex.*	6	R. O. Y. G. B. I. V	Brilliant	8	Ci. St.	s.	Falling	4:29 p. m., 5th	12:48 p. m., 8th.
	6	R. O. Y. G. B. I. V	Bright	8	Ci. St.	n.	Falling	4:29 p. m., 5th	12:48 p. m., 8th.
	6	R. O. Y. G. B. I. V	Bright	8	Ci. St.	n.	Falling	4:29 p. m., 5th	12:48 p. m., 8th.
	7	O. Y. G. B	Dim	8	Ci. St.	se.	Falling	4:29 p. m., 5th	12:48 p. m., 8th.
Leesburg, Ga.*	.....	.....	.....	.....	.....	.....	.....	.....	.....
Madison, Wis.	5	R	Bright	10	Ci. St.	nw.	Stationary	11:30 a. m., 4th	9:00 a. m., 8th.
	7	R	Bright	3	Ci. St.	nw.	Stationary	11:30 a. m., 4th	9:00 a. m., 8th.
				Few.	Cu.	.....			
	9	O	Brilliant	5	Ci. St.	sw.	Falling	9:30 a. m., 8th	8:02 a. m., 10th.
	21	R	Bright	5	Ci. St.	nw.	Stationary	5:22 p. m., 17th	7:00 p. m., 22d.
				5	A. St.	nw.			
Nashville, Tenn.	.....	.....	.....	.....	.....	.....	.....	.....	.....
Royal Center, Ind.*	27	R. B	Dim	4	Ci. St.	sw.	Falling	4:30 p. m., 26th	5:40 a. m., 28th.
	30	R. B	Dim	7	Ci. St.	w.	Falling	10:50 a. m., 30th	D. N. p., 30th.

*Aerological station.

** Beginning with part nearest sun or moon. R, red; O, orange; etc.

SOUTH CAROLINA METEOR OF APRIL 23, 1918.

By RICHARD H. SULLIVAN, Meteorologist.

[Dated: Weather Bureau Office, Columbia, S. C., June 5, 1918.]

A remarkable meteoric phenomenon was witnessed throughout South Carolina and portions of adjacent States between 7.20 and 7.42 p. m., Eastern Standard (75th Mer.) Time, on April 23, 1918.

The meteor came out of the firmament from the north like a flash of lightning, and exploded with three distinct prongs of light like an immense skyrocket. It cast a noticeable glare on the twilight, and left a cloud of whitish-gray smoke or cosmic dust suspended aloft similar in many respects to a cloud from a shrapnel shell or aerial dynamite bomb. The position of the meteor at the time of explosion, as closely as could be ascertained, was as follows: As viewed from Charlotte, N. C., altitude 65°, azimuth 60°; Charleston, S. C., altitude 10°, azimuth 155°; Columbia, S. C., altitude 30°, azimuth 172°.

The cosmic cloud apparently remained stationary for 22 minutes, and during this period the wind velocity at the earth's surface ranged from 8 to 10 miles per hour from the southwest. After the explosion the length of the cloud appeared to be about twice the apparent diameter of the full moon, and its width about half its length. Its position in the sky appeared to be east and west, and it was so high that reflections from the far-set

sun were very pronounced, particularly on two of the denser portions of the dissipating dust. The cloud disintegrated into several parts, and spread out laterally and downward toward the east and west. Apparently it did not come fully under the influence of the forward movement of the atmosphere until about nine minutes after the explosion, and this would indicate a very thin, rarefied condition aloft.

Reports of detonations from the explosion, covering many points in the central and northern parts of the State, range from 1 to 10 minutes after the phenomenon was observed, with an average of about 3 minutes. Several observers reported two or three distinct explosive sounds, resembling distant thunder.

Observations indicate that the explosion of the meteor occurred over a point in southeastern Cherokee County, somewhat to the southward of the village of Wilkinsville, possibly near the junction of Gilkins and Thickety Creeks.

NOTE.

In his complete report of this meteor Mr. Sullivan presents a large amount of data, including more than a hundred observations of its direction, and a few fairly accurate azimuth readings, as already noted. These all agree very closely in locating the section of the country above which the meteor appeared. Unfortunately no instrumental, and only a few eye observations, of altitude angles were obtained, and among these there is considerable discrepancy. Probably the most complete and reliable record of the movement of the meteor cloud was made by Mr. J. W. Ruff, industrial power engineer of the Charleston Consolidated Railway & Lighting Co. His observations were made by eye, but were later verified by a transit, using certain objects, such as trees, house tops, etc., as references. These readings, and some that have been furnished by other observers, indicate that at the time of explosion the meteor was at an altitude of practically 95 kilometers. Soon after this time the cloud was apparently about 2 kilometers long and 1 kilometer wide.

There seems to have been some conflict of opinion as to whether the cloud actually moved or not; but at the height computed above even a considerable movement might take place without being noticed, unless the observer was using an instrument. Summarizing the collected data, and giving greatest weight to that furnished by Mr. Ruff, it is evident that the cloud had a very marked eastward movement, averaging during its visibility about 250 kilometers per hour. The lower portion moved more rapidly than the upper, the difference in velocity being about 5 kilometers per hour for each change in altitude of 1 kilometer. At the time of disappearance the cloud was about 12 kilometers long and less than half as wide, with a depth of about 7 kilometers. During its visibility the denser portions settled about 8 kilometers and the lighter portions but a few kilometers, showing that, even at that height, the light particles were held practically in suspension by the rarefied air. Its final disappearance was probably due to its dissipation and to the passing above it of the rays of the far-set sun.

Meteoric observations are of value to the meteorologist chiefly because they furnish information concerning the height of the atmosphere and the direction and velocity of motion of the air at great altitudes. The successful reduction and practical use of such observations depend upon the accuracy and number of observations of the altitude and azimuth angles. The altitude angle, preferably measured with an instrument, or at least checked by an instrument, is of prime importance. The angle should be read at some definite time or times, for example, at first and last appearance, or at some definite point in the meteor's path. If the meteor leaves a visible trail or cloud it is very desirable to have as many successive readings of its altitude and azimuth angles as possible, so that its movement may be accurately plotted.

In collecting data on such a phenomenon a scheme similar to the one used by Mr. Sullivan seems worthy of adoption. It consists in arranging the information gathered from all sources in tabular form under the following headings:

1. Position of the observer.
2. Altitude and azimuth readings (also whether by eye or instrument).
3. Time of occurrence, or of appearance and disappearance.
4. Brief description of phenomenon.
5. Accompanying phenomena, and any other notes.
6. Name of observer.

If the phenomenon attracts considerable attention, enough entries under each of these headings can probably be obtained so that their reduction will add materially to our knowledge of the movements of the atmosphere at heights where observations by any other means are impossible.—*W. S. Cloud.*